

## THE SURGICAL TREATMENT OF TRIFACIAL NEURALGIA.

WITH REPORT OF EIGHT CASES OF RESECTION OF THE GASSERIAN GANGLION.

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ON September 12, 1892, I had the pleasure of assisting Dr. L. McLane Tiffany in doing a Gasserian ganglion operation according to the Hartley-Krause method, here in the city of Baltimore. It so happened that it was the first one that had ever been performed here, and followed soon after the introduction of the Hartley-Krause method. That patient, I may say, did perfectly well and is still living to-day, and has had no recurrence of pain whatever since operation. In her case she had been operated upon a number of times, having had done all the peripheral operations with a temporary relief following each one, and then recurrence of all the trouble.

Dr. Tiffany was not only the pioneer, I might say, in this city, but did a vast deal for the progress and advancement of this work, and his results were better than any operator at that time. He also published a most excellent and exhaustive article entitled, "Intracranial Operations for the Cure of Facial Neuralgia," giving his experience with a large number of cases and also collected and tabulated all the work that was done in this line up to the time of publication of his article. This article was published in the "Transactions of the American Surgical Association," volume xiv, 1896, and in *ANNALS OF SURGERY*, November and December, 1896. In this article Dr. Tiffany goes over the entire subject most thoroughly, having collected in all 108 cases, and gives a brief history of each one. Of these cases nearly two-thirds were subjected to the Hartley-Krause operation, nearly one-fourth to that of Rose, 7 to that of Horsley, 4 by the method of Doyen, Quenu 4, and Novaro 1, while 1 is uncertain since no method is mentioned. There

were 47 operators, 25 of them operating once each. The outcome of his research in this line shows that out of 108 cases there were 24 deaths, a mortality percentage of 22. The principal causes of death were put down as shock and sepsis. This report includes 10 cases operated upon by Dr. Tiffany himself; this shows his mortality to be less, namely, 2 deaths in 10 cases. Dr. Keen's cases in this tabulated article show 2 deaths in 10 cases likewise. It will also be noted in looking over the ages recorded in these various tabulated cases that the vast majority of the cases were markedly advanced in life, feeble, and had been worn out by long-continued suffering, and it is surprising to note how well they stand the surgical shock of this formidable procedure. In my series of cases, likewise, the age limit has been well advanced; the cases have universally been aged people.

I had the privilege of assisting Dr. Tiffany in most of his own personal cases and am in a position to speak accurately of the great skill with which he performed and accomplished these operations. The mortality following his work was low, as shown above, and the results so far as relief of pain were absolutely perfect, and he should be given great credit for having perfected the operation in a marked degree. He by no means adhered strictly to the Hartley-Krause method, but departed from their method in many points where the change was for the bettering of the method of approach and a proper access to the ganglion. For instance, he soon gave up the osteoplastic flap and took away sufficient amount of bone in order to enable him to have good access to the middle fossa. It was only in the very earliest cases he attempted to put back the bone flap, and I might here state that in none of his cases, so far as I remember, were there any permanent serious complications following the operation. There were some temporary eye disturbances, which all cleared up in a short while, save for one case (Case CVI in his series), where a second operation was done; the patient at the time of operation having a well marked and bad corneal ulcer. In this case the patient recovered and pain was abolished, but eye was lost.

It has been my experience to do all the peripheral operations where the trouble has been limited to one or more nerves, with the usual results of temporary relief; most of those cases, however, have come later on for the ganglion operation. In some few of the ganglion operations that I have done, in fact most of them, the peripheral operations have been done by some other surgeon with the usual results, namely, recurrence of pain, before they came for the more serious ganglion operation. I have in several of my cases, however, done the ganglion operation primarily without resorting to the division of the nerves; in those cases it has seemed clear to me that nothing short of a ganglion operation would give them relief.

In my first cases I made use of the Hartley-Krause method; since then I have used a lower route, dividing the zygoma and discarding the osteoplastic flap, going lower in temporal fossa and biting away the bone in order to make my opening sufficiently large. This is a method very similar to Cushing's method. I have never yet strictly confined my opening in the skull to the arch under the middle meningeal artery, but often get into the artery, and if so, tie it in the dura. The dura is then stripped up from the middle fossa down to the second division of the fifth; then the third division is sought for; the dura is then split between these two roots and the top layer of the ganglionic sheath is raised and the ganglion uncovered.

The recent results following removal of the ganglion in toto have been, as I said before, most satisfactory and most permanent in the cases that have been watched for any length of time. Whether the recurrence of pain will follow, that is a subject difficult to know, due to the short period since many of the operations have been done. It seems to be pretty definitely settled that total removal of the ganglion as distinct from a partial operation, is attended by permanent cessation of pain. It is certain, so far as the physiologic knowledge of the process of nerve repair goes, that there can be no peripheral regeneration of the system of sensory neurons after a thorough removal of the ganglion, so that those that come out successfully from a well conducted operation are relieved of their pain at least, even

if they do have possible eye complications. There have been some temporary eye symptoms in almost all of my cases. In my last one the sixth nerve was interfered with for quite a while, and the man had paralysis of the external rectus and certain amount of diplopia, which cleared up entirely after several months. The great drawback to the advancement of the operation has been the high mortality attending it. I think the keynote of the successful accomplishment of the operation is the avoidance of haemorrhage, and if this can be accomplished the operation is generally not attended by any great degree of shock. I am convinced it has been the cause of the majority of deaths. Sepsis and brain infection should be avoided. Haemorrhage explains, doubtless, the high mortality variously estimated at 20 per cent. This is needlessly high, however, and should not be; and I am convinced that if the statistics of the operators who are doing most work in this line were looked into the percentage mortality would be found much lower. In a recent monograph by J. Hutchinson, Jr., on "The Surgical Treatment of Trifacial Neuralgia," he goes over the subject very thoroughly and calls attention to the work of Sir Victor Horsley, whom, he states, has performed 120 operations with but 6 deaths; so, likewise, with the work of other operators, I think the statistics will show the mortality to be very much less.

The avoidance of haemorrhage is at times an exceptionally difficult thing in my experience. I think I voice the sentiments of almost every surgeon when I say it is the principal thing we fear, and I venture to say that it has been the experience of almost every surgeon to meet with serious haemorrhage in one or more of his cases. I am convinced that in one of my cases the death was unquestionably due to the amount of blood lost during operation. In those cases where I have not had haemorrhage to annoy me the patients have made uninterrupted recoveries; their pain being immediately relieved and their progress most satisfactory, in fact, have been up in the course of 36 to 48 hours. After this their recovery is speedy, and as a rule they are out of the hospital at the end of a week, with

wound entirely healed. It is astonishing to see how rapidly these patients convalesce; as was mentioned above, most of them are well advanced in age and their resisting powers generally have been weakened by long-continued pain, and it is perfectly surprising, that when they do do well, how rapid their recovery is and how little their general health is interfered with during convalescence.

The operation is one in my judgment absolutely not an operation to be demonstrated to a class. It is an operation that requires all the dexterity that a skillful operator can possess, and it is one that he is unjustified in attempting to let those who are looking on attempt to see; by doing this he not only wastes time but is apt in his demonstration to do damage and get into a haemorrhage which may cost the life of his patient. I believe that the proper procedure is to do it slowly, carefully, and to center one's entire attention on it and not attempt to stop and let others see. The first assistant is the only one that can see anything. It is done through a small opening and the work is to be done between intervals of haemorrhage which well up from deep down in middle fossa. Pressure will usually stop without difficulty these haemorrhages that well up, and after they have been stopped by pressure maintained for a short while, then one proceeds on in endeavoring to enucleate and free the ganglion from its bed. By working carefully around the third division and slowly progressing backwards towards the pons one can in this way get at the back of the ganglion, or sensory root, without encroaching upon and endangering the patient's life by opening into the cavernous sinus. If the ganglion can be worked free from its bed in this way it can be sectioned across behind the ganglion without undue haemorrhage. The sectioning across of the sensory root back of the ganglion is the most essential step in getting a complete subsidence of the pain. When this is done successfully it cuts off completely all the sensory distributions conducted through the various branches of the fifth nerve, and it is a matter of no special moment whether the ganglion is left in or whether it is removed; the division back of the ganglion is the most im-

portant thing, and pulling forward the divided distal end is all that is necessary, so that it cannot reunite with the proximal end; by pulling it forward so that regeneration cannot become established is all that is necessary, and the actual pulling out of the ganglion, which may be attended by serious haemorrhage, can be avoided. When the attempt is made to get it raised out of its bed before it is well worked up from behind, one always has difficulty with serious haemorrhage and one is liable to tear into the cavernous sinus. The top layer of the ganglionic sheath should be separated from the ganglion first, until it is well uncovered, and no attempt should be made to separate the ganglion from its under ganglionic sheath until all the other work has been completed. It is an operation that is so trying on the operator—so tedious and so long drawn out—that a day should be set apart for it, with nothing else attempted on that day—certainly no operation before a Gasserian ganglion is done. I do not know how it is with other operators, but it takes me a number of hours to complete one satisfactorily.

I wish to append a brief report of the eight cases. The first two cases were done by the Hartley-Krause method with the osteoplastic flap, but in neither of them was bone replaced. Others were done by lower incision, followed by division of the zygoma and the skull opening made low down in temporal fossa, first with the chisel and then with rongeur forceps. In my recent cases the anterior arm of the incision has been so planned as not to divide the nerve going into the occipito-frontalis, which when divided, causes drooping of the eyelid and disappearance of wrinkle of brow on that side. In this list of cases it will be noted there have been two deaths; one from ether pneumonia, and the other from shock, unquestionably brought about by haemorrhage at time of operation.

CASE I.—Female, white, aged seventy; operation November 30, 1899.

*Previous History.*—Had suffered with trifacial neuralgia for five or six years. No peripheral operation had been done previously. It had apparently invaded all the branches. Operation. Hartley-Krause. The ganglion was removed. Immediate result.



Gasserian ganglion removed December 28, 1890. No. 1, Sensory and motor root. No. 2, Third division (inferior maxillary). No. 3, Second division (superior maxillary). No. 4, Where it was torn loose from first division. The specimen has been so turned over that it does not show it in the proper position.

FIGURE 2.



Mrs. M. F., white, aged 75, operated upon Dec. 28, 1896, for facial neuralgia. Entire Gasserian ganglion removed. Picture taken ten days after operation. Right side of face inside of pencil marking shows area of complete anesthesia to touch, pain and temperature changes.

Abolishment of pain; patient made uneventful recovery; healed under one dressing. Ultimate result. No recurrence of pain.

*CASE II.—Removal of the entire Gasserian ganglion and its sensory and motor roots back nearly to the pons, as a primary operation for the relief of facial neuralgia, involving the three divisions.* Female, white, German, aged seventy-five; operation December 28, 1899.

*Previous History.*—She was a typical sufferer with trigeminal neuralgia for five years, involving all three divisions of right fifth. Attacks were less frequent at first but very severe from their incipiency, increasing in frequency and severity until the last six months when they have become almost constant.

*Previous Treatment.*—Medical treatment of all kinds had been resorted to; morphia in large doses would not alleviate; no operative interference of any kind had been done. On account of involvement of all three divisions, primary removal of the Gasserian ganglion was done.

*Operation.*—Hartley-Krause. Osteoplastic flap, which bone flap was not put back. When the skull was opened and the osteoplastic flap turned down the second division of the fifth at the foramen rotundum came into view first, after the brain was lifted from middle fossa; the third division at the foramen ovale was next seen and the ganglion soon uncovered. The two divisions, third and second, were cut across and the ganglion picked up by a pair of artery forceps and evulsed from its bed and a long piece of the sensory root came away with it (as shown in Fig 1). There was an excessive flow of blood and I feared I had torn into the cavernous sinus. Pressure was made by gauze pledgets; when these were removed blood still welled up, so I presume the cavernous sinus was torn into. I packed this cavity with two pieces of tampon sterile gauze, bringing them out at the lower angle of wound. The flap was replaced and wound closed with subcuticular silver-wire sutures. To prevent foreign body getting on anaesthetic cornea, I closed the eye by suturing the lids together. Immediate result: Patient reacted nicely and expressed herself as entirely free from pain, the relief of which was complete and permanent. The sutures were removed on the fifth day and the lids were opened; no irritation whatever about the cornea. A Butler's shield was placed over the eye and worn. At the end of ten days all dressings were removed

and wound entirely healed, as will be seen by accompanying photograph; the patient was entirely free from all pain. The markings on photograph indicate area of anaesthesia \* (Fig. 2).

Examination of patient four weeks after operation is as follows: Muscles supplied by left branches of facial show normal innervation. When patient compresses teeth forcibly the right masseter muscle does not stand out as prominently as the left, since it is less forcibly contracted, one can readily palpate this difference in the hardness of the muscles on both sides when thus contracted. Pharyngeal reflex normal on both sides. No evidence of any vasomotor irritability about the face, the color being in general rather pale. Sense of taste dulled on anterior two-thirds of right half, patient being unable to distinguish sour or sweet substances, but distinguishes very bitter (quinine and, strange to say, salt). Slight dulling to temperature and pain on right side of tongue. Both eyes are moist; no particles of dust in right cornea, which is perfectly clear. Pupils equal and react well to light and accommodation. Tongue in median line. No paralysis of any facial muscles except right half of frontalis, which is almost completely paralyzed, not the orbicularis, however. This paralysis may be due to cutting the nerve supply of the muscles in large flap operation. Ultimate result: Recovery and permanent cessation of pain.

CASE III.—Male, white, aged seventy-six; operation March 14, 1901.

*Previous History.*—He had had facial neuralgia for a number of years.

*Previous Treatment.*—Two or three years prior to my operating upon him he had had a peripheral operation done for the removal of the third division through angle of jaw by Dr. Tiffany. This gave him temporary relief, but it returned with all its vigor, attacking other branches of the fifth. He was suffering excruciating agony, with the pain ranging through all three divisions.

*Operation.*—Hartley-Krause. I got the ganglion beautifully uncovered and removed it as neatly and nicely as any

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\* This is among my earlier cases and the scar is very pronounced; in my later cases the opening has been much smaller and the depression is not nearly so marked.

case I ever did, and had practically no trouble whatever. He reacted nicely, but unfortunately, as it was a ward case I did it in the ampitheatre before a large class of students; it was a bitterly cold day and considerable time was taken up in endeavoring to demonstrate to the students the ganglion in its bed; this naturally prolonged the operation and prolonged the effects of ether. Immediate result: His wound did perfectly well and was practically all healed, but the day following operation he developed ether pneumonia which ran a fatal course, and on morning of fifth day following operation resulted in death. This death should not be attributed to the ganglion operation, because the case was done perfectly quietly with no disturbance whatever, no haemorrhage of any consequence, and no shock; it was purely a case of ether pneumonia, and really should not be attributed to the removal of the ganglion, because it would probably have occurred from any operation.

*CASE IV.—Female, white, aged fifty-one; operation November 7, 1903.*

*Previous History.*—Began with attacks of neuralgia in lower teeth.

*Previous Treatment.*—Her teeth had all been removed at various intervals without alleviation. In 1891 Dr. Tiffany divided the inferior dental branch in the foramen at the angle of the jaw; this gave her relief for seven months, when a pain recurred not only in the inferior dental branch but in the inferior maxillary, and was more intense in second division, so a second peripheral operation was done by Dr. Tiffany; the superior maxillary was removed by incision just under orbit; large section of nerve was removed by twisting and contortion. She returned to the hospital November 5, 1903, complaining of neuralgia in violent form; the last peripheral operation gave her relief for five months. She came in this time complaining of pain distributed over entire region of fifth. On entrance she stated she had been suffering constantly, getting worse and worse each day, since July 1, 1903. (I failed to note that the supra-orbital nerve was also cut previously.)

*Operation.*—Right Gasserian ganglion was removed November 7, 1903. The method of approach was a little different from the Hartley-Krause method; flap was made lower and opening

in skull was made lower and enlarged sufficiently to enable me to have access; zygoma was divided and skull entered much lower. A horse-shoe incision, having for its base the zygoma, about  $1\frac{1}{4}$  inches wide at this point and about two inches high, was made, cutting through the skin, muscle and fascia. The zygoma was then exposed and cut at each extremity, and flap of skin and muscle and fascia retracted with the zygoma. The periosteum being peeled back, a small area about one-half inch in diameter was then chiseled out and the opening enlarged with rongeur forceps to about one inch in diameter; this exposed the dura with the middle meningeal, which was ligated with two silk sutures and cut between. The dura and brain were then lifted gently from middle fossa and second and third divisions came into view, and by dissecting between these two the ganglion was soon uncovered and removed without difficulty. Certain amount of bleeding occurred when ganglion was gotten away, which necessitated a bit of gauze being left in for pressure and brought out at lower angle of wound. The soft parts were replaced and flaps stitched around with interrupted stitches of fine silk; at the first dressing intervening stitches were removed and in that way left practically no scar. Immediate result: Patient was somewhat shocked but soon rallied and made an uninterrupted recovery; the gauze packing was removed at end of thirty-six hours and wound allowed to close; at the end of a week she was up and about with wound entirely healed. The eye symptoms following operation were temporary, consisting of dilated pupil, some fixity of eye, and ptosis; this all cleared up in a few days and then disappeared entirely. Ultimate result: Recovery; no recurrence of pain. The highest temperature in this case was 100; it reached normal on second day after operation and ran normal balance of stay in hospital. She was dismissed from hospital as cured on tenth day.

CASE V.—Female, white, aged fifty-seven; operation December 2, 1903.

*History of Disease.*—Has had persistent neuralgia for twelve years. Twelve years ago the trouble began with creepy sensations along the right cheek which became very annoying, but to which she gave no significance after probably four months. Then she was suddenly taken with this intense neuralgia which lasted

a few minutes and then passed off; this history went on, trouble growing worse each month, disappearing and recurring at intervals.

*Previous Treatment.*—In 1901 Dr. Tiffany did a peripheral operation, resecting the supra- and infra-orbital nerves on right side, which afforded relief until February, 1902 (nine months). At this time the attacks began again, of the same character but with more intensity and more frequency, persisting through several days and then disappearing for a month or more. This history of recurring pain continued until she entered the hospital November 29, 1903. She then complained of paroxysmal attacks of the most excruciating character, continuing for about one minute and recurring at intervals of about five minutes. The pain comes on as a sharp penetrating pain; to use the patient's own words, "Like a red hot vice twisting the nerves," radiating over the eye, under the eye, along the cheek back to the ear and along roof of mouth on right side. When in a paroxysm patient seems to suffer most intensely, cries quietly and presents a most pitiful picture, with tears running from the eye and water dropping from the nose. Physical examination: She is a large, well-built, well-preserved woman, in good physical condition.

*Operation.*—The method of approach was a little different from the Hartley-Krause method; flap and opening in skull were made lower; zygoma was divided and skull entered much lower. A horse-shoe incision, having for its base the zygoma, about  $1\frac{1}{4}$  inches wide at this point and about 2 inches high, was made, cutting through skin, muscle and fascia. Periosteum was peeled back, chisel being used for opening skull, which opening was enlarged by rongeur forceps, brain was lifted from middle fossa, the second and third divisions were clearly seen and the capsule of dura covering ganglion was stripped from off top of ganglion and second and third divisions were cut and ganglion removed. There was considerable haemorrhage in attempting to uncover and isolate ganglion. The wound was closed in my usual way, using interrupted silk sutures and dressings applied. Immediate result: Patient was very little shocked; pain abolished immediately upon awakening from anaesthetic; wound healed and no reaction followed operation. She was sitting up on third day and left the hospital on tenth day; no unfavorable eye symp-

toms in this case at all; motion unimpaired. She wore a Butler's shield to protect the eye from foreign bodies and cornea was anæsthetic. Ultimate result: Recovery, and has had no recurrence of pain.

CASE VI.—Female, white, aged seventy-eight; operation March 20, 1906.

*History of Disease.*—She has had neuralgia involving two lower branches of right fifth for the last fifteen years; the beginning of it was apparently in her third division, and four or five weeks after it began in the third division it started in the second division; there has never been any pain referable to the first or ophthalmic division. Has never had any previous operation.

*Operation.*—The second and third divisions were removed and with them part of the ganglion, which came away by torsion. Immediate result: Cessation of pain and uninterrupted recovery. Ultimate result: So far there has been no recurrence.

CASE VII.—Male, white, aged fifty-seven; operation March 27, 1906.

*History of Disease.*—He has suffered with trifacial neuralgia for the last twelve years, having intervals of quiescence; during last several months has had to stay away from business on account of the severity of the attacks which are now almost constant. The first and second division of the fifth seem to be at fault. I advised a Gasserian ganglion operation and sent him to the University of Maryland Hospital.

*Operation.*—Under ether I made a horse-shoe incision in the right temporal region extending up from the zygomatic arch about 5 cm.; the base of the incision was about 4 cm., which corresponded to the zygomatic arch. The skin flap was dissected down to base line of this flap and the temporal fascia was opened, incision running in similar way to the skin incision, but the size of this flap was smaller from one-half to three-fourths of an inch; this was turned back likewise. I uncovered the zygomatic arch, stripped back periosteum from it, and with strong biting forceps cut it across; the periosteum was likewise separated from it back near to temporal bone and there cut across in order that the zygomatic arch could be pulled down with the soft parts, thereby enlarging the space. A similar horse-shoe flap was then

made through the temporal muscle, still smaller in size than the fascia; this went down to the periosteum of the skull and it was pulled down with the zygomatic arch, and the skull uncovered deep down in the temporal fossa; a small trephine was then inserted and a small groove started in the bone; I abandoned the trephine and took a chisel and opened the head at this point; as soon as the bone was raised, or skull entered, there was bleeding from a branch of the middle meningeal artery; by making compression over this I was able to stop bleeding, and then enlarged opening by rongeur forceps to size of half-dollar, biting downwards, so as to get down to base of fossa as far as possible. First the rongeur forceps bit away a portion of the temporal bone and then a greater wing of the sphenoid; there was very little bleeding during these steps of the operation to get into the skull; the bleeding points were arrested, most of them tied off. Then with a brain elevator I stripped up the middle lobe, with its dura attached, from the middle fossa and soon came down upon the foramen ovale, through which passed the third division of the fifth; after getting that located I separated the dura attachment between the third and second divisions with a knife, and with my Gasserian ganglion spoon, the dura which made the top layer of the ganglion was stripped back, uncovering the ganglion on top; during this there was some little bleeding, but not much. In elevating the dura I elevated the arch of the middle meningeal artery, so that it could be clearly seen coming out of the foramen spinosum. I failed to note, however, that when the foramen ovale came into view, there was a marked prominence of bone known as the crista infra-temporalis, or ridge of bone projecting up in the fossa, interfering very markedly with the structures in the region of the ganglion; this I had to chisel and bite away with the rongeur forceps before I could proceed with the extraction of the ganglion. By proceeding slowly and stripping up the upper layer of dura I was able to liberate the ganglion, definitely and clearly showing its three branches going off. I proceeded slowly behind and was able to isolate the sensory root proximal to the ganglion; this root was gotten up and held by forceps; a loop was passed around the second and third divisions and silk ligature passed around; they were pulled up and cut across with scissors close to the foramen; then with the forceps attached to the sensory root, I tried to evulse the ganglion with

the sensory root from its bed; this root was torn across and a small bit of the ganglion came away with the forceps, but in doing this I must have torn into the sinus, because there was a great deal of bleeding which was more or less easily controlled by packing with gauze, but it did not stop sufficiently for me to continue in enucleating the balance of the ganglion; every time the gauze was taken out the bleeding would go on to such an extent I could not see what to do. This continued for quite a while, and as the patient had been under the anaesthetic for a long time, and the bleeding did not seem to be stopping, and in view of the fact that I had torn across the sensory root proximal to the ganglion and had cut across the second and third divisions of the fifth and had enucleated the ganglion from its bed thoroughly, I decided I had better abandon the attempt to get the rest of it away for fear he would not recover; so I packed a small bit of gauze at the site of the bleeding and closed the wound by layers; first, the temporal muscle was brought up and stitched to its cut fibers; then the fascia was brought up and stitched, and the skin flap likewise brought back into position and fastened by interrupted sutures of fine silk. The whole wound was closed except for this small drainage which came out at the lower and posterior angle of the wound next the ear. Immediate result: He reacted from operation fairly well and was in pretty good shape.

March 30, 1906.—He had immediate quiescence of pain through the distribution of the fifth following operation, and had complete anaesthesia all over the region of the fifth distribution; he had some reaction the first twenty-four hours and some slight elevation of temperature and complained of great pain in his back, in lumbar region, and in back of his neck; this I attributed to the long position on the operating table, because he was on there at least four hours; he went on the table with a certain amount of lumbago and I think it was made worse. The dressings were changed on March 29, forty-eight hours after operation, and the gauze packing was removed entirely. There had been considerable oozing, so I put back a very small piece of gauze only a short distance in the drain track. On the thirtieth I dressed him again, took this out, and there was considerable cerebrospinal fluid which came out following it, and with each pulsation of the brain there was a drop of this cerebrospinal fluid which oozed out; a

small wick of gauze was put back again on account of this fluid draining. A number of the sutures were removed here and there; wound is healing primarily and all is going well; has had no discomfort whatever in face, some pain in back, but none in back of neck.

April 2, 1906.—On April first I removed all further sutures from his head and left out all gauze packing; his wound healed primarily; pain has entirely abated; his eye shows signs of paralysis of the external rectus muscle, showing that there is either temporary or permanent paralysis of the sixth nerve, because it does not work. The conjunctiva of the eye is clear, but right over the pupil there seems to be a little speck which at first looked like a foreign body, but I am fearful that it may mean the beginning of conjunctival necrosis, which is the forerunner of conical ulcer. The eye was washed out with borax solution; there is absolutely no sensation in the conjunctiva. Ultimate result: Recovery. Eye symptoms all cleared up, and he has had no recurrence of pain whatever.

CASE VIII.—Female, white, aged thirty-six; operation August 9, 1906.

*History of Disease.*—Has had pain in right side of face since last September. The pain involved practically all divisions of the fifth.

*Previous Treatment.*—Has had all her teeth extracted without obtaining relief. Entered University of Maryland August 4, 1906.

*Operation.*—Under ether I opened down by making a horse-shoe flap in right temporal region; dissected skin back a certain distance and then cut temporal fascia around, less large than skin flap, divided zygoma, sectioned it across and cut temporal muscle down to bone. The temporal muscle was pulled down with temporal fascia and section of zygoma and skull uncovered down near base. Then with a chisel I made a small opening in skull as far down as I could get and bit away sufficient opening to enable me to get inside middle fossa. Then with brain retractor I pushed brain and elevated it away from middle fossa and worked my way down to second division of fifth nerve as it goes up to foramen; after getting that well exposed I divided between it and third division the envelope of dura which holds in place the

ganglion; I then stripped the upper end of dura back and uncovered the ganglion. I had considerable bleeding, but finally got it so I could see the ganglion clearly and showed it to a number of lookers-on. I then passed with a long needle a string around second division and began to enucleate the ganglion from its bed; there was considerable bleeding. I then got around third division of fifth, got it up and cut it across. I put a clamp on ganglion side and cut second division across; then with a clamp on ganglion I endeavored to get it up out of its bed; the clamp pulled off, bringing away only a small bit of ganglion; this was followed by considerable oozing; endeavoring to get this oozing stopped I pushed ganglion well up out of its bed, up above middle line of base; by using gauze pledges to stop the oozing I finally got this sufficiently stopped to seek for rest of ganglion and endeavor to remove it. After getting field clear I put down a pair of hysterectomy forceps and tried to grasp remains of ganglion; I thought I had clamped it and made a pull on it, and when I did so, a tremendous whirlpool of blood gushed out, so I presume I tore the sinus; the clamp came away and I packed as quickly as possible large pledges of gauze down in middle fossa to arrest haemorrhage, which was more profuse than any I have ever seen in a ganglion operation. I finally got it controlled by pressure, and after holding it for a little while I thought I would remove this packing and see if haemorrhage had been controlled; in attempting to remove it the same whirlpool of blood came out, not venous bleeding but arterial haemorrhage. I packed it as quickly as possible, but it welled out all around and told very markedly on patient. This seemed to control it and I made a third attempt to remove this tight packing to see if I could not get on with less packing and see if pressure had controlled it. The same thing occurred on third trial; the gushing of blood was equally terrific and told on patient; her pulse went up and she showed evidence of haemorrhage, so I packed it as speedily as possible and left in a large piece of gauze which practically filled middle fossa, and by making firm pressure on it the haemorrhage was stopped. Then I brought temporal fascia lightly together with fine silk and brought the skin flap up in place and stitched it around, leaving gauze coming out of the wound just in front of the ear. I put on dressings, bandaging them tightly so as to make pressure continuous to control further bleeding. When

she went off the table her pulse was quite weak, feeble and rapid. When I left the hospital her pulse had toned down and pupil dilatation had contracted considerably; there was an enormous dilatation in right eye, which showed evidence of pressure against motor oculi. Result: Patient died from shock the morning following operation.